Learner Centered Software Design to Empower Physiology Education

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Abstract

Misconceptions in physiology undermine students' knowledge. New uses of technology in education offer interesting alternatives to correct these problems. This poster presents a design strategy based in user-centered design and the result of such process: an interactive program to support learning of respiratory physiology. This is an ongoing project, and future efforts will measure the effectiveness of this design tool in medical education.

Introduction

Research evaluating the prevalence of misconceptions in respiratory physiology has shown that students' understanding of the response of the respiratory system to exercise is commonly problematic. These conceptual errors have been associated with defective mental models that could be acquired in early stages of the individuals' education. Furthermore, these conceptual errors can persist throughout the doctors' education, eventually interfering with clinical decision making.

The correction of these misconceptions using traditional teaching methodologies has met with limited success. Technology-based interventions have been tested but the results have been diverse. Most of the explanations of these inconsistencies have been articulated around the complexity of the learning process and the diversity of the technologies used.

Objectives

The objective of this project is to propose and apply a method for the development of educational software in this domain. Our strategy is designed to empower learning and correct faulty mental models.

Methods

In order to organize the global workflow of the software design process, we have applied a user centered approach[1]. In this method, the development follows a set of steps that improve the definition of the application requirements. These steps can be summarized as: Functional Analysis, User Analysis, Task Analysis, and Representational Analysis.

Functional Analysis: The objective of this development stage is to define the domain contents and learning requirements. In other words, this stage will define the project scope, and the learning objectives for the application.

User Analysis: The previous requirements and objectives need to be matched with the characteristics of the set of users or learners. Efforts are directed to define the individuals' characteristics in terms of previous knowledge and skills, attitude, preferences and special requirements.

Task Analysis: Defines the set of tasks that will help us to complete our learning objectives. These tasks are going to be associated with the information previously collected and with the pedagogy preferred by the instructors.

Representational Analysis: Determines the best media to represent the required content or task. This decision is also associated with all the previously collected information, but also with the characteristics of the information itself.

Formative evaluations, using user satisfaction surveys and direct observation have helped us to improve our design.

Results

In our respiratory physiology unit, we defined the general structure of our application, and applying a systemic approach defined three groups or categories of knowledge associated with the application: Anatomy of the System (Structural level), Dynamics of the System, and Control of the System. This way, the software presents the contents in three sections: Basic Anatomy of the Respiratory System, Respiratory Dynamics Overview and Respiratory System Response to Exercise.

This educational software uses interactive animation to represent the rules of this system, allowing the student not only to view the normal function, but mostly to test their conceptions, contrasting and challenging the learner's mental models. Anatomy and ventilatory dynamics are represented as text and animations respectively.

Discussion

Using this methodology we have developed an application prepared to be tested in the field of respiratory physiology. Next, our team will be evaluating the effectiveness of this software in the classroom, comparing the results obtained with other computer-based strategies. Future research will also expand this knowledge, measuring not only traditional learning, but also evaluating changes in conceptual understanding using mapping techniques. The results of these evaluations will help us to understand the role of technology in learning biomedical science concepts.

References

1. Zhang J, Patel VL, Johnson KA, Malin J, Smith JW. Designing human-centered distributed information systems. IEEE Intelligent Systems 2002;17(5):42-47.